TEXTILE RESEARCH

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TEXTILE RESEARCH

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Outstanding Features in

This Month's Issue

Douglas Woolf Joins Institute

Douglas G. Woolf resigns as editor of *Textile World* after 27 years in order to give full time to the cause he has so long advocated—textile research. (See page 2.)

The Future of the Corporation

The answer to the survival and form of the state and the corporation, or large business company, rests to a considerable degree upon the extent to which both are managed with benevolence. (See page 5.)

Research Manager

Giles E. Hopkins in joining the staff of Textile Research Institute, Inc., brings to the Institute a broad technical experience as well as an industry-wide viewpoint toward research. (See page 11).

Structure of the Wool Fiber as Revealed by the Electron Microscope

Whereas with the optical microscope only fibrils are to be observed within the cortical cells, the higher resolving power of the electron microscope has made possible the resolution of still finer microfibrils. (See page 15.)

Infra-Red Drying

Additional information on the application of radiant energy to the drying of textiles is given in a letter to the editor. (See page 21).

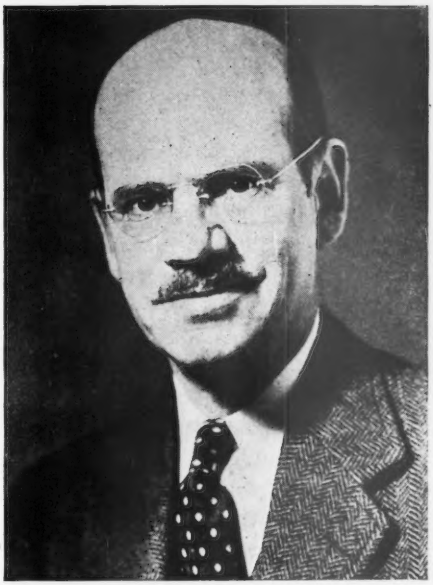
To Further the Cause of Textile Research

Douglas Woolf Joins Institute

DOUGLAS G. WOOLF, editor-in-chief of *Textile World,* has resigned after twenty-seven years' association with that publication to become vice-president and director of information of the Textile Research Institute, Inc., New York. In taking this step, Mr. Woolf is putting into action his personal advocacy, over a quarter of a century, of research as the most vital need of the textile industry.

In his new connection, which will start on October 15, he will direct all the information services of the Institute, which include the magazine, TEXTILE RESEARCH, of which Julian Jacobs continues as editor, and the abstracts and supplementary publications. He will also direct the projects which will be formulated by the economic research committee of the Institute, under the chairmanship of Robert R. West, president of The Esmond Mills, Inc., who recently accepted that responsibility. Mr. Woolf will also have charge of research in employer-employee relations, and will assist the president of the Institute as liaison officer with various committees, research projects, and with members. His efforts will be directed particularly toward the post-war problems of the textile industry.

In announcing Mr. Woolf's appointment, Fessenden S. Blanchard, president of the Institute, stated: "We are extremely fortunate to have been able to secure the services for the Institute of a man of the outstanding qualifications of 'Doug' Woolf. Well-known among all branches of the textile industry for his ability and courageous leadership as editor of *Textile World,* he will now be able to



Douglas G. Woolf, vice-president and director of department of information, Textile Research Institute, Inc.

give his full time to the cause for which he has been a pioneer for so many years—textile research. In the important new work he is undertaking, he will, I am sure, be able to perform a service of the greatest value to the industry."

After leaving Cornell University in 1911, Mr. Woolf spent several years as a textile chemist in cotton bleacheries. He went to Persia in 1914 and installed there his own process for dyeing wool for oriental rugs. In 1916, he joined *Textile World* as an assistant editor and has been with that publication since then, with time out for service in World War I as an aviator in this country and in France. He became managing editor in 1928 and editor-in-chief in 1930. During his editorship, *Textile World* won two first awards, and one honorable mention, from the Associated Business Papers for service to its field, and Mr. Woolf won two personal awards for outstanding editorials.

He has served as president of the National Conference of Business Paper Editors; as secretary of the New York Business Paper Editors Conference; as secretary of Committee D–13 of the American Society for Testing Materials; and as a member of the executive committee of Textile Research Institute, Inc., and chairman of its publications and publicity committee. He is author of "The Business Paper Editor at Work," published jointly by the Associated Business Papers and the McGraw-Hill

Book Co.; and of countless articles on textile problems.

In commenting on his new connection, Mr. Woolf stated: "I have a deep conviction that the future of the textile industry depends upon a completely open-minded approach to its post-war problems, involving not only competition from other industries for its markets, but also intra-industry competition among fibers and types of machinery. That means research. Fortunately, there is a current growth of interest in research in all parts of the textile industry, as evidenced by the formation of several new organizations. There is no limit to the need for textile research; consequently there is no reason for competition among these new research enterprises. But there is need for coordination. It is my hope that Textile Research Institute, Inc., representing as it does all branches of the industry and all sections of the country, may serve as a coordinating influence, by means of which all the organizations will work together toward a common objective; the elevation of the textile industry to a position of security for capital, management and labor.

"Certainly, all of us who remember the textile aftermath of World War I realize that nothing short of an all-out research offensive by the industry as a whole can prevent a far more destructive textile aftermath of World War II.

"The job I am starting on now is the crystallization of the observation and study of more than a quarter of a century. If I can now serve in a practical way to bring the textile industry nearer to an acceptance of research as the only real solution of its problem I shall feel that my years of preaching this doctrine will not have been in vain."

Mr. Woolf is a member of the Textile Institute, of Manchester, England; the American Cotton Manufacturers Association, of Charlotte, N. C.; the National Association of Cotton Manufacturers, of Boston, Mass.; the Southern Textile Association, of Charlotte, N. C.; the American Society for Testing Materials; the National Conference of Business Paper Editors; the New York Business Paper Editors Conference; the National Press Club, of Washington, D. C., and other organizations.

Study of Trends in Modern Thinking Reveals Influences Affecting

The Future of the Corporation

By H. WICKLIFFE ROSE*

The following concludes a series of related articles by Mr. Rose. The first, "Inter-Research," appeared in the June issue of TEXTILE RESEARCH; *the second, "Research and the Patent System," appeared in three parts, in the July, August, and September issues. Reprints of this series bound together in a pamphlet titled "Planning Corporate Research and Development," will shortly be available. Copies may be had without charge by addressing either H. Wickliffe Rose, American Viscose Corporation, Wilmington, Delaware, or from* TEXTILE RESEARCH, *10 East 40th St., New York 16, N. Y.*

SINCE OUR ECONOMIC SYSTEM was placed on trial as a result of the collapse in 1929, investigations of the concentration of economic power have been made and much has been said and written upon the subject. Because the state has been attacked from without and the corporation has been attacked within, there is no time better than the present to take stock and to see as clearly as possible what are the future prospects for these institutions. In so doing we must be prepared to modify and to improve wherever necessary to save and to strengthen whatever is worth having. When it is clear what is worth having, then on every possible occasion we should fight for its defense.

The corporation appeared as a monster dragon after the fires of economic depression had swept the world. The dragon was guarding a hoard of gold and patents were the teeth and claws with which he defended it. There appeared from many quarters bright-eyed Sieg-

* H. Wickliffe Rose, coordinator of research planning, American Viscose Corporation, Wilmington, Delaware.

frieds, bearing swords wrought in the forges of academic learning, and eager to slay the dragon and free the gold. The smoke of the dying fires still obscured the monster somewhat but there he was breathing fire and feeding flame with flame.

Early conclusions were drawn, that, since a minority of corporations controlled a majority of the wealth, and since a redistribution of the wealth seemed to be a solution to depression, the corporation must be deprived of its wealth and of its power to concentrate it.

The swords were plunged into the dragon from every side. He gave blood and treasure, but before he was dispatched completely the swords had to be withdrawn and turned elsewhere, for the country had been attacked. At that point the plot of the old Norse myth changed completely. The Siegfrieds were now at war, and as there was need of all the power the country possessed, they returned to the dragon: but now they found that the smoke had cleared, and there, on a pile of glittering eggs of gold, was not a dragon but a goose.

The State and the Corporation

Now the question is not whether the corporation will survive, but whether it, the state, and democracy will survive in the form in which we know them.

Herbert Hoover was one of the first to recognize as early as 1914 that the conflict which broke out in Europe at that time was no mere military war, but was a world social revolution, of which the armed conflict was but one manifestation. He was as close to the primary human problem as one could be: that of feeding the people. He started at once, while in Europe, to collect documentary evidence of the social revolution, which today in Palo Alto constitutes the greatest library on social revolution in the world. The records already established in the library are unique and give ample proof of the great tidal wave of thought which is surging over the world.

If we could plot the curve of that wave, we might have some clue to the question of the survival of the state and of the corporation. Recently Eric A. Johnston, president of the United States Chamber of Commerce warned that this country was heading for totalitarianism.

He did not refer to the war program and the measures which we know must be adopted for unity of purpose in winning the war, but to the trend of government which started after the economic collapse in 1929 and which continues war or not.

In the long term view there is considerable evidence of such a trend. The economic collapse was only one more manifestation of the great tidal wave following World War I. When the collapse finally happened here, there were already dictators in Europe. The fact that economic poverty could exist in the wealthiest nation in the world was evidence, clear to everyone, that something was fundamentally wrong. The pattern of dictatorship having been established, and although the office has now been warped by aggression and conquest until it is difficult for us to remember the point of view, nevertheless in 1932 there was a considerable demand in this country, from men in various positions in business, for a dictator to solve the economic ills.

We may not have realized it at the time, but that demand rose from the similarity between dictatorship of a state and receivership of a corporation. The dictators in Europe were receivers of practically bankrupt nations. At one extreme, Russia, while denying capitalism, established the largest corporation in the world and appointed a receiver, thereby freezing all previous obligations and debts and establishing in one man full contractual powers for the corporation. Since that time Russia, step by step, is rediscovering capitalism on a nationalistic basis.

Japan, at the other extreme, where a few families were the business and, at the same time, the state, also gave to a receiver the full powers over the corporation, or state, whose economy was fast approaching collapse.

Between these extremes, the other bankrupt nations, Italy, Germany, and Spain, appointed receivers under various conditions, but all with the same net result, that the state froze previous obligations and gave full powers to one man for management of operations. Meanwhile, the solvent nations of Europe retained their management and went about their business ignoring these receiverships for the time being.

(Continued on page 8.)

In the United States we tried to appoint a receiver for a solvent corporation. Dictatorial powers given to solve the economic emergency were then strengthened for the war emergency; and dictatorial powers have been maintained from one economic extreme to another, from an emergency for want of work to an emergency for want of manpower. This form of government may become known as a rule by maintenance of emergency. If it proves impractical for a receivership to be maintained over a solvent state, it is feared by some that fiscal policy might dissolve that paradox.

Although the bloodless revolution that is taking place in this country was inevitable, its accompanying ills can be heightened by its acceleration. The good, which is being accomplished by changes that have corrected faults and abuses in our economic system, can be offset by loss of other good through efforts to accomplish, within the scope of two or three political terms, what would normally take place in two or three generations.

In plotting the curve of the great tidal wave through the points which are clear to us, the future of the state and the corporation, in some form, seem closely related, and as man's future universe and world will be changed from that which he knows today, so will his future state and corporation. The two have always been close, jealous and, to some extent, in competition. The history of the building of empire is the story of the state following after trade and industry and taking over the general control and protection of what they have established.

The answer to the survival and form of the state and the corporation, or large business company, rests to a considerable degree upon the extent to which both are managed with benevolence. In this sense the word benevolence does not mean paternalism. It covers the true meaning of willing good in the ultimate public interest.

There has been much political misuse of the term public interest. Politically the term brackets only voting blocs. A prominent layman, speaking recently in the public interest of Victory Gardens, said that he asked an official of the Department of Agriculture why they had only so recently discovered the amateur gardener. The reply was that he does not constitute a voting bloc. Con-

fusion of the public interest with political interest has always been prevalent, and careful distinction must be made in planning or predicting the future of research, patents, the corporation, and the state.

Our state failed to survive as a colony because of the lack of benevolence of the Crown in its exploitation of the colony. India survived as a part of the empire during the same period only because of the integrity and benevolence of one man, Warren Hastings, in spite of the Crown's every effort to undermine him in his Governorship. In India the state had followed the East India Company and had exercised the royal prerogative by taking over the function of government which the Company had performed. Today the true public interest in India is one of the worlds most perplexing problems, in which the state and business are inseparable.

Now that the corporation and business in this country are currently recognized by the State as a necessity, whether evil or good, and even though business is under more government regulation than ever before, it is an appropriate time to emphasize five positive points of our own which are opposed to the negative school of thought that has had business on trial for the past decade.

1. The corporation or publicly owned stock company is the normal and natural means of conducting large scale and complex enterprise involving many individuals.

2. The creation of wealth and industrial life will grow increasingly complex as time goes on with the result that provision for the conduct of large scale business must be maintained. Its socialization should not be forced.

3. The individual must have the incentive of freedom of action, choice, and opportunity, and he must not be enslaved, either in his work or out of work, by the subsidizing of voting blocs for the self-perpetuation of any political party.

4. It is still possible to increase wealth in this country to a degree greater than anyone can predict, and it must be permitted to increase. Wealth must not be stifled, and the incentive to develop wealth must not be destroyed, by the negative political economy which considers the wealth of the country as concrete and limited as a deck of cards, which can be shuffled and dealt and

played indefinitely without increasing the total wealth of the players by one cent.

5. A benevolent state and a benevolent corporation can guide the evolution of both and the increment of wealth to the greatest common good and in the true public interest. Benevolence is counter to exploitation.

The Corporation and Research

If we assume the political survival of the corporation in some form or other, we must next consider research and its part in the competitive and financial survival of the corporation. In a highly competitive business, research is considered necessary to the survival of the corporation. In fact, research creates competition, and is, in many industries, a competitive race in itself. If the business is large scale but not competitive, then it is either a monopoly or unattractive to the investing public, in either of which cases its future is doubtful unless as a monopoly, such as the telephone business, it is benevolent. It is argued by some that research creates wealth by increasing the market value of the corporation. At least it creates products, jobs, and whole industries, and certainly they create wealth in turn.

The planning of research and development in wartime is being conducted, probably quite generally, in such a way that the war program comes first, and that wherever the war developments may have a future use those uses are planned on paper at least. Without interfering with the war program, but coincident with developments for that program, a certain amount of textile research is being conducted, in order to have at least a few of the answers ready when the great day comes.

We expect to see an increased use of rayon and synthetic textiles. We are planning improved and new products for the time when peace returns to the world, and we assume that other corporations are doing likewise.

The signs are all around us. Wonderful accomplishments of industry for the war program, pointed out with just pride in advertisements today, give only tantalizing hints of what is being stored up in potentialities for the future world.

Textile Research Institute Engages Giles E. Hopkins for Position of

Research Manager

GILES E. HOPKINS, one of the best known research men in the textile industry, has been appointed research manager of the Textile Research Institute, Inc. A graduate of Massachusetts Institute of Technology, Mr. Hopkins was for many years technical director of the Bigelow-Sanford Carpet Company. He was one of the organizers of the Industrial Research Institute, a group of directors of research brought together to study the administration problems peculiar to research and technical personnel. He succeeds Malcolm E. Campbell, who has been appointed dean of the textile school at North Carolina State College, but who will continue to be active in the affairs of the Institute as a member of its technical research committee.

Giles E. Hopkins, research manager, Textile Research Institute, Inc.

In announcing the new appointment, Fessenden S. Blanchard, president of the Textile Research Institute,

Inc., stated: "We in the Institute feel particularly fortunate in securing the services of Mr. Hopkins because he has always had an industry-wide point of view, and a recognition of research as a tool not to promote any one fiber or any one type of equipment, but rather as a channel to progress for the textile industry as a whole. And that is what the program of the Textile Research Institute, Inc., has as its objective."

In addition to his connection with Bigelow-Sanford, Mr. Hopkins has been chemist with Factory Mutual Fire Insurance Laboratories; chemical engineer with the Research Division of the United Shoe Machinery Corp.; technical director of the U. S. Asbestos Division of Raybestos-Manhattan, Inc.; and, more recently, chief of the Industrial Production Section of the Reoccupation Division of the office of Economic Warfare. His technical society activities included organization of the wool committee of the American Society for Testing Materials; memberships on the executive committee of that society, and of the Industrial Research Institute; and chairmanship of a special committee of the Textile Research Institute's committee directing a research project on the drying of textile fibers. In his new association, he will continue to be active in the war effort, as the Textile Research Institute, Inc., is engaged in research contracts for the Government.

Mr. Hopkins will maintain close contact with the members of the Institute, surveying the research requirements of the industry and interpreting them into programs of common interest. He will organize and supervise specific research projects which will include applied and cooperative research.

Mr. Hopkins will have the advisory help of the technical research committee of the Institute, whose members include: W. D. Appel, chairman, A. G. Ashcroft, F. Bonnet, Winn Chase, Alban Eavenson, Milton Harris, Charles J. Huber, W. O. Jelleme, Rinaldo A. Lukens, Thomas Nelson, E. R. Schwarz, R. W. Vose, A. C. Walker.

RESEARCH ACTIVITIES

The annual meeting of the Textile Research Institute, Inc., will be held on Thursday, November 18, 1943, at Hotel Roosevelt, New York. Dr. Hugh S. Taylor of Princeton University will be the guest speaker at the luncheon. Besides the usual morning meetings of members and directors, important research meetings —the subjects of which will be announced later—will be held in both morning and afternoon.

The Nineteenth Exposition of Chemical Industries will be held in New York at Madison Square Garden December 6 to 11.

Warren E. Emley, chief of the Organic and Fibrous Materials Division, National Bureau of Standards, retired October 1, after more than thirty years of service. During this period Mr. Emley has represented the United States and also the Department of Commerce on several important missions abroad. He is the author of 143 publications, including 11 books and has also been active in various scientific and technical associations. He is on the Textile Foundation's advisory committee for textile research.

Dr. Archibald T. McPherson, who has been in charge of the rubber section of the National Bureau of Standards, has succeeded Warren E. Emley as chief of the fibrous materials division.

Dr. Robert E. Rose has retired after 22 years as director of the technical laboratory at the du Pont Dye Works, Deepwater, N. J., to assume new duties as consultant to the laboratory. Previous to joining the du Pont company in 1917, Dr. Rose had served on the

faculties of St. Andrews University, Scotland; University of Nottingham, England; and University of Washington, Seattle. He is a vice-president of Textile Research Institute, Inc.

It has been reported that a new type of high-tenacity rayon yarn which has not been saponified is in the course of development by the du Pont acetate division.

United Merchants & Manufacturers, Inc., announces the consolidation of two committees to develop new fibers and fabrics for postwar use. Mr. Edward L. Schlesinger will head the company's research on new fibers and materials which may have a textile application. He will coordinate the company's technical and mechanical facilities needed for this purpose.

The fall meeting of the Society of the Plastics Industry is to be held November 8 and 9 at the Waldorf-Astoria Hotel, New York, N. Y.

"What six budding industries of today do you think will contribute most to progress, employment, and the general welfare of America during the next 10 years?" This question was asked on a ballot sent to its readers by *Research Viewpoint,* published by Gustavus J. Esselin, Inc. A recapitulation of the vote indicated a tie for first place between the field of aviation, and that of radio and electronics, each receiving 90 percent of the votes cast. Plastics was third with 87 percent; housing fourth with 50 percent; alloys and metallurgy tied with food processing for fifth place with 43 percent; and synthetic rubber was sixth, having received 36 percent of the votes. Textiles were eleventh on the list, receiving 19 percent of the votes cast.

Physicists at Bureau of Standards Report Results of Studies of the

Structure of the Wool Fiber As Revealed By Electron Microscope

An investigation of wool with the electron microscope is reported by Charles W. Hock and Howard F. McMurdie † in the October issue of Journal of Research, National Bureau of Standards. The following article is a condensation of this report:*

AN INVESTIGATION OF THE WOOL FIBER with the electron microscope was undertaken in order to get more data on the structure of the fiber and its constituent cells, and to correlate this information with results previously obtained by other methods. Specimens were prepared for examination by various physical and chemical procedures.

Over a wide range of magnifications the cortical cells always showed a distinctly fibrous structure. Whereas with the optical microscope only fibrils were observed within the cortical cells, the higher resolving power of the electron microscope made possible the resolution of still finer microfibrils. The scale cells, on the other hand, showed little internal organization. This difference in structure between the fibrous cortex and the non-fibrous or amorphous cuticle, is believed to be of fundamental importance in interpreting many properties of the fibers.

Preparation of Specimens

For a satisfactory examination with the electron microscope, specimens should not be more than a few tenths of a micron thick. Unfortunately, the finest wool fibers do not even approach this limit, so that various means must be used to obtain sections suitable for examination.

* Research Associate at the National Bureau of Standards, representing the Textile Foundation.

† Division of Clay and Silicate Products, National Bureau of Standards.

Inasmuch as the methods of preparation may bring about changes in the structure of the specimens themselves, it seemed likely that the best understanding of the wool cells could be achieved by the examination of specimens which had been prepared by a variety of chemical and physical procedures. In the present investigation specimens were prepared by the following four methods:

Method 1. Untreated [1] and undamaged wool reacts slowly to enzymes, but it is unusually susceptible to attack if, for example, the disulfide cross-linkages have been ruptured by reduction with thioglycolic acid and then methylated to prevent reformation of the linkages. After treatment with pepsin for several days to a week, cortical and scale cells are released from the wool fibers. For the present work, cells obtained by this procedure were washed repeatedly with distilled water until the suspension was neutral, whereupon a drop of the suspension was placed on the specimen holder of the microscope and allowed to dry. The scales were less than 0.5 micron in thickness and hence satisfactory for examination with the electron microscope. The cortical cells were too thick to allow passage of the electrons except at their tapering ends, and accordingly observations were confined principally to these regions.

Fig. 1. Group of scales released by action of pepsin on treated wool fibers. Stained with Orange II.
Photomicrograph × 1500

Method 2. Another method for obtaining scales for examination with the electron microscope involved treat-

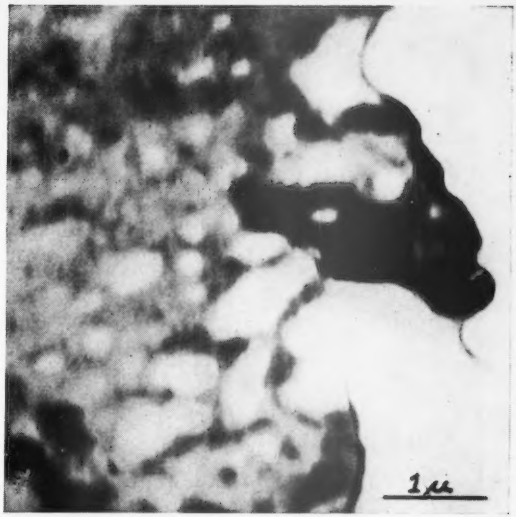


Fig. 2. Part of scale, released from treated wool by pepsin, showing its mottled appearance and fimbriate margin.

Electronmicrograph × *16,000*

ing the fibers with acid. Methods 3 and 4 involved separation of the scale from the films by mechanical means.[2]

Scales from five different samples of wool were examined at several magnifications. Although the structural pattern varied depending on differences in experimental technique, all the scales, regardless of the method of preparation or of the samples from which they came, showed certain similarities. For example, the margin of the distal part of the scale, i.e., the part away from the point of attachment and not covered by overlapping scale, was relatively thick and dense, and hence showed little evidence of a finer structure. The proximal end of the scale, on the other hand, was thin enough to allow passage of the electrons and thereby reveal details. Thus, the scale as a whole is evidently wedge-shaped, decreasing in thickness from its distal to its proximal end.

Structure of the Scale Cells

The scales, unlike the cortical cells, show little internal organization even at the highest magnifications obtainable with the optical microscope. Usually this instrument shows clearly that the scales overlap in a manner comparable to that of shingles on a roof, but there is

[1] In this discussion wool fibers which received no specific chemical treatments before being placed in enzymes will be designated *untreated* wool, whereas the fibers which were reduced and methylated before being subjected to the action of enzymes will be called *treated* wool.

[2] For a complete description of methods 2, 3, and 4 see the complete report in *J. of Research*, Natl. Bur. Standards (Oct. 1943).

almost no indication of a pattern within the scales themselves (Fig. 1). The higher resolving power of the electron microscope, however, does reveal a pattern in scales released by certain procedures. For example, Fig. 2 is an electromicrograph of part of a scale which had been prepared in exactly the same way as the scales photographed in Fig. 1. The greater detail of the electron micrograph is evident, the scales appearing rather mottled, with less dense areas scattered throughout the denser regions. The less dense areas were irregular in shape, and varied in size up to about 1 micron. Generally speaking all the scales separated from the fibers by chemical action had this mottled appearance. Specimens which were prepared by identical procedure did not, however, always have exactly the same appearance. Thus, although the scales obtained by treatment with sulfuric acid usually had a typical mottled appearance, occasionally they exhibited a more porous or vesiculate pattern. Likewise, the scales released by the action of untreated wool with pepsin often has the typical appearance of chemically-released scales. Frequently, however, they underwent disintegration by the electrons.

Fig. 3. Single cortical cell from treated wool.
Photomicrograph × 1500

Structure of the Cortical Cells

The examination of cortical cells with the electron microscope confirmed and extended the results previously obtained with the optical microscope. With the latter instrument it has been shown that cortical cells are spindle-shaped and that they have a striated appearance, except for a granular nucleus near the center (Fig. 3). That the cells are fundamentally of fibrous structure, as indicated by their striated appearance, can be verified by dissecting single cortical cells with microneedles, whereupon numerous fibrils can be separated. Between crossed nicols the fibrillate part of the cortical cell appears birefrigent, whereas the granular nucleus does not.

Because of their size, observations with the

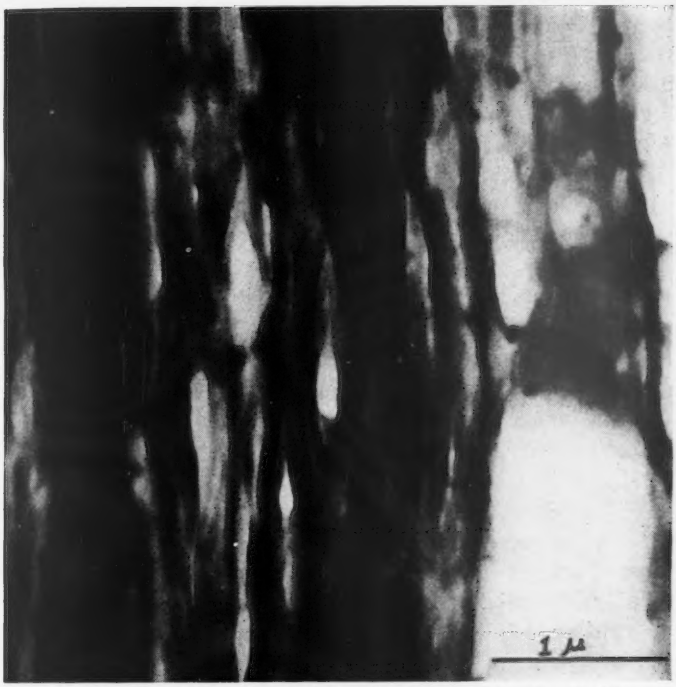


Fig. 4. Part of cortical cell showing fibrils and microfibrils.
Electronmicrograph × *26,500*

electron microscope of the cortical cells released by pepsin were confined principally to their thin and tapering ends. There are good reasons for believing, however, that, except for the nucleus, they have a similar structure throughout. It was found that over a wide range of magnifications the fibrous nature of these cells was still evident (Fig. 4). However, whereas only fibrils were observed with the optical microscope, the electron microscope resolved still finer filaments which, in the present investigation, will be called microfibrils. Zahn has similarly distinguished between fibrils and microfibrils in cortical cells. The micrograph shows, essentially, parts of two fibrils, each made up of microfibrils and each connected to the other by additional microfibrils. The microfibrils, like the fibrils, do not appear to be constant in width, but to vary from a few hundred to about a thousand Angstrom units. Although the microfibrils are

roughly parallel to the long axis of the cell, they do not present a picture comparable to a pile of matches in parallel alignment. They are observed, rather, to coalesce, so that apparent spaces of various sizes up to several tenths of a micron are formed between them. Adjacent fibrils are connected by other microfibrils which, however, have a much looser texture. In other words there are more microfibrils per unit in the dense region (fibrils) than in the less dense regions (interfibrillar regions) of the cortical cell. It should be borne in mind that the light areas recorded on the micrographs, and which are especially abundant in the interfibrillar regions, do not necessarily indicate open spaces, but may only indicate areas which contain a material that is less dense than the surrounding microfibrils.

Upon examining specimens from the reduced and methylated wool in the optical microscope, before and after their exposure to the electrons, there was no evidence that the cortical cells had been adversely affected by the electrons. Similarly, micrographs taken with the first flow of electrons through a specimen did not appear to differ from subsequent micrographs taken after longer bombardment. The behavior of cells from wool which had not been reduced was, however, quite different. Just as soon as the beam of electrons struck these specimens pronounced changes in structure occurred. The cells literally exploded, and assumed a characteristic appearance. In the optical microscope the bombarded cells looked dark, charred, and distorted. This behavior, which is not uncommon with thick sections of organic materials, has been described previously in the cotton fiber.[3]

There is abundant evidence from chemical, physical, and microscopic studies in support of a fundamental fibrous structure of textile fibers, and to this knowledge the present investigation of wool gives additional support. It is important to note that studies with the electron microscope support previous evidence which indicates that only the cortex and not the cuticle appears to have a fibrous structure.

[3] R. B. Barnes and C. J. Burton, Com. Dyestuff Reptr. 31, 254 (1942).

Letter to the Editor Discloses Additional Information on

Infra-Red Drying

By F. G. McGaughlin*

In the special report "Infra-Red Drying—a Literature Survey" issued by Textile Research Institute, Inc., and in the article "Infra-Red Drying of Textiles" which appeared in the August issue of Textile Research (also in "New Facts on Infra-Red Drying" in the August, 1943, issue of *Textile World*) the author, Stefan L. Grapnel, makes several statements which I feel need clarifying.

Having made laboratory tests on small pieces of goods with but one type of gas burner (Carbomatic Corp. Burner), the author of the above mentioned article concludes by stating that further research should be carried out. His suggestion is that this should be done with actual industrial equipment and that continuous sheets of fabrics of considerable length ought to be used. With that suggestion, this writer is in hearty accord. Small scale tests with one particular burner are not necessarily indicative of the results to be obtained on full size industrial equipment with other makes of burners.

1. Reference is made on page 5 of the report to an article in *Textile World* for January, 1943, which states that in connection with a certain plush drying operation, 90 lamps of 1000 watts each were used and that approximately 12.5 lbs. of moisture were removed per minute. From these data Mr. Grapnel's calculations show that these lamps would develop 5,110 B.t.u. per minute. Careful consideration of these figures shows that the fantastic efficiency of 244 percent would be achieved.

The writer re-checked the above application with

* Red-Ray Manufacturing Co.

Textile World (the magazine in which this application was originally described), and found that the 12.5 lbs. of water per minute was the total moisture evaporated by the lamps and by the steam dryer, and that the 90 lamps, having an input of 5,119 B.t.u. per minute, instead of evaporating 12.5 lbs. of water per minute actually accounted for 2.5 lbs. of water per minute. The efficiency of the lamps on this basis was 48.8 percent.

2. In another paragraph, in commenting on an article which appeared in *Industrial Gas* of April, 1943 (this article was written by Mr. E. V. K. Schutt), on the results of burner applications made by the Red-Ray Manufacturing Co., Mr. Grapnel states that the surface temperature on the fabric dried was as high as 3,000° F. Mr. Grapnel erred in the reading of this article, as the article stated—"The burners maintain temperatures of from 2,500° to over 3,000° F." This was in a paragraph dealing only with the operation of the burner and not with its application to cloth drying. Actually, the Red-Ray Burner reaches surface temperatures as high as 2,600° F. in an open air application, and when used inside a kiln or in a muffle furnace for welding operations, etc., temperatures in excess of 3,000° F. have been recorded.

It is also stated in Mr. Grapnel's article that a refractory temperature of over 2,000° F. is improbable. This opinion is, no doubt, based on the operation of the burner used in the tests. In a recent test by the U. S. Testing Company, using Red-Ray Burners in the open and under no reflecting surfaces, a refractory temperature of 2,600° F. was officially recorded.

4. Mr. Grapnel also states that during his tests with the Carbomatic Corp. Burner, the refractory temperature never exceeded 1,600° F. This fact explains his conclusions that the drying was accomplished by convected heat and not by radiant heat, for according to Stefan and Boltzmann, the loss of energy from a body emitting full radiation (a so called "black body") is proportional to the bounding surface and to the fourth power of the absolute temperature. Expressed in B.t.u. per hour per square foot of surface, the radiation from such a body at T degrees (Rankine) is very nearly 1600 $(T/1000)^4$, in which 1600 is an approximate conversion factor derived from Mark's "Mechanical Engineer's Handbook."

Very hot bodies, regardless of their physical characteristics, seem to emit heat at nearly the above rate. At lower temperatures, the physical surface characteristics have an influence, but an incandescent surface is almost a perfect radiating body. In most cases, in addition to hot surfaces, cooler surfaces are present to absorb radiant heat. These surfaces in turn radiate at rates dependent upon their temperatures. The net effect is measured by the difference between the amount emitted by the hot body, and that returned by the cooler. The net transfer of heat in B.t.u. per hour per square foot is

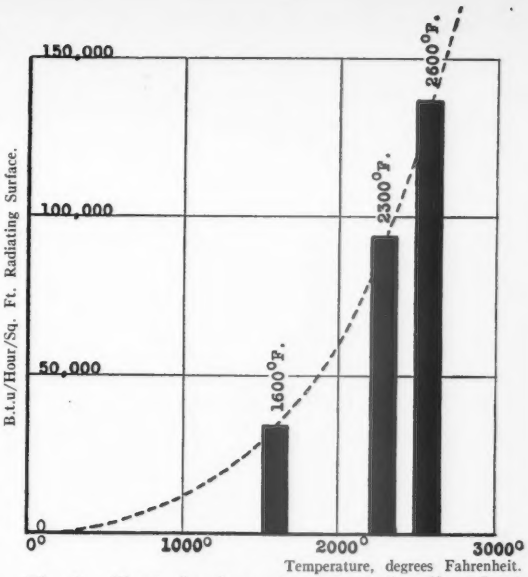


Fig. 1. Chart showing net amount of radiant heat emitted per square foot of radiant surface at different temperatures Fahrenheit.

$$H = 1600\ [(T/1000)^4 - (t/1000)^4]$$

in which T = temperature of hot body in absolute degrees F., t = temperature of cooler body in absolute degrees F. (Rankine). The above may be verified in combustion engineering handbooks.

It is, therefore, apparent that the quantity of heat wet cloth receives by radiation increases very rapidly as the temperature of the burner surface rises. As an example, a drop in temperature from 2,500° F. to 2,400° F. will reduce the amount of heat transferred by radiation by 12 percent. This is shown in the accompanying graph.

Summarizing, it can be said that the quantity of radiant heat imparted to the cloth to be dried depends: (1) on the difference of the fourth powers of the absolute temperatures of the cloth and burner surfaces; and (2) on the area of the incandescent surfaces utilized (length and number of burners used).

RESEARCH AIDS

Statistics of the Wool Textile Industry*

The annual "Bulletin" of the National Association of Wool Manufacturers recently issued by the Association is considerably enlarged over previous issues. In addition to the usual statistics relating to the wool industry the following are among the chapters added: maximum price regulations on wool, yarns, civilian fabrics and sales of textiles for military purposes; explanation of Wool Conservation Order M–73; renegotiation of Government contracts; and abstracts of some of the recent reports of wool research. The section listing the Army and Navy specifications for woolen textiles has been enlarged and includes federal testing specifications. This book should be in the library of everyone interested in the wool textile industry.

*Bulletin of the Wool Manufacturers. *National Association of Wool Manufacturers, 386 Fourth Ave., New York, and 80 Federal St., Boston, Vol. 72, 700 p. Bound in cloth. Price $10.00.*

The Microscope and Its Use*

This book is unique, in that it confines itself to the actual use of the microscope and the practical use and application of accessories. It is intended as a guide to aid technicians and students in the use of the instrument. It combines the authoritative experience of an educator who has taught the subject and that of an optical man who has had to meet and help solve many and diverse problems in the use of the microscope as an instrument for research and teaching.

A chapter on the microtome is an important inclusion. Other chapters include the stereoscopic microscope, the metallurgical microscope, and the polarizing microscope. The book is profusely illustrated.

* The Microscope and its Use. Franke F. Munoz and Dr. Harry A. Charipper. *Chemical Publishing Co., Inc., 26 Court St., Brooklyn, N. Y. 334 pp. Price, $2.50.*

The Dermatitis Test*

In the past several years many courts have had to decide on cases where the plaintiff complained that he developed rashes or skin irritations from wearing certain garments, or using certain beauty products or chemicals.

The presence of irritating substances of a chemical nature is readily determinable through two types of tests—the patch test and the dermatitis test. The determination of toxic properties is made by the toxicity test.

THE PATCH TEST: this consists of having at least fifty persons wear during a minimum of four days in contact with the skin, a swatch of the fabric concerned or a swatch of dermatitis-free cotton impregnated with a solution of the chemical in question. After four or more days the patches are removed and the skin observed for irritation. The inconveniences are the delay and the cost of the test.

THE DERMATITIS TEST: this test consists of injecting intradermally into rabbits an extract of the fabric or a solution of the substance to be tested. This test is accurate, speedy and the cost nominal.

THE TOXICITY TEST: when a toxic substance is injected intraperitoneally in mice or rats, the animals die within a few hours after the injection. If the animals survive the chemical is considered safe. The test is accurate, rapid and inexpensive.

* THE DERMATITIS TEST AS A NECESSARY ROUTINE CHECK-UP. *Testing League Bulletin. U. S. Testing Co., Inc., 1415 Park Ave., Hoboken, N. J.*

Laboratory Glass-Blowing*

Described in the first chapters of this useful manual are the properties of the materials (glass and gas) used by the glass blower and the tools required by the laboratory worker for ordinary work. Chapter Four deals with the fundamental operations of splicing and making joints. These are followed by chapters describing more advanced and special operations that may be required in making up special laboratory apparatus.

* MANUAL OF LABORATORY GLASS-BLOWING. R. H. Wright. *Chemical Publishing Co., Inc., 26 Court St., Brooklyn, N. Y. 90 pp. Price, $2.50.*

ABSTRACTS

Members of Textile Research Institute, Inc., desiring complete copies of articles abstracted may obtain photostat copies at cost by addressing the Institute's office, 10 East 40 St., New York 16, N. Y. The price of a photostat negative is seldom more than 50 cents per page of original text.

Translations of articles appearing in foreign language publications and abstracted in TEXTILE RESEARCH, *will be furnished at cost when the original publication is obtainable.*

ANALYSIS: TESTING LABORATORY METHODS

Action of Light on Cellulose

Action of Light on Cellulose. Application of copper number determination to cellulose acetate. Ralph E. Montonna and C. C. Winding. *Ind. Eng. Chem.* **35**, 782–784 (July, 1943).

The authors apply a modification of the Heyes method for copper number to cellulose acetate which first has been finely subdivided by precipitating from an acetone solution with three volumes of boiling isopropyl ether. The ether is evaporated off and the residue dried 48 hours over P_2O_5. Samples of 0.25 g. are weighed out into 150 cc. suction flasks and reacted 3 hours at the boiling temperature of water with 95 cc. of Braidy's solution added 65 cc. at once and the remaining 30 cc. after heating one hour. A reflux condensor is used over the flask and nitrogen is passed in through the sidearm. The reduced copper is dissolved in acidified ferrous ammonium sulfate and titrated with 0.04 normal potassium permanganate. The results are quite comparable to those obtained with cellulose itself except that since 75 to 80 percent of the weight of the acetate is due to the acetyl radical, the copper numbers are in reality that much greater than the numerical values indicate. It is shown that the copper numbers are inversely proportional to the viscosities of the acetates used but proportional to the length of exposure to radiation from a Cooper-Hewitt mercury vapor lamp. It is concluded that oxygen is not necessary to the degradation of cellulose or cellulose acetate but that moisture must be present.

Infra-Red

Visual observations in the infra-red. J. M. Preston. *J. Soc. Dyers and Colourists* **59**, 141–43 (July, 1943).

The author reports that observation in the 7200 to 8000A infra-red range may be made if the bright colors of the so-called visible wave-lengths are excluded. With Ilford infra-red filters in light-tight goggles all light of shorter wave-length than 7200A is cut out, yet vision is still possible. Many colors that are dark in the visual range appear light in the infra-red because they absorb less light in this range than in the "visible" region, although there are many exceptions, particularly sulfur colors, which appear dark. There are striking variations among dyes of the same class and this fact is useful for identification purposes. For example two black direct dyes, Chlorazol Black ZVS and Chlorazol Black ES, reflect about the same in the "visible" region but in the infra-red appear relatively almost as black and white. Ostwald's achromatic series is

found to show approximately the same percent reflectance under white light as under infra-red and therefore is useful as a scale for comparison in the roughly quantitative measurement of the infra-red reflectance of colored materials.

CHEMICAL AND PHYSICAL RESEARCH

Identification of Sulfonic Acids

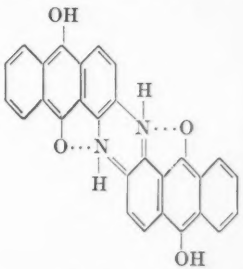
The identification of some sulfonic acid reduction products of azo dyes. Ping Chen and E. J. Cross. *J. Soc. Dyers and Colourists* **59**, 144–47 (July, 1943).

The identification of sulfonated reduction products of azo dyes, particularly in the case of isomeric compounds which possess nearly identical reactions, is a difficult problem. Although in general aromatic sulfonic acids have no definite melting points, they form well defined salts with aromatic bases often with sharp melting points. It was found that acetylation of the amino-group of the arylaminemonosulfonic acids with acetic anhydride in the presence of pyridine took place readily at room temperature and that by properly adjusting the conditions the pyridine salts of acetylaminosulfonic acids could be separated directly from the reaction mixture. The pyridine salts (or p-toluidine salts which were more satisfactory in some cases) of the acetyl derivatives of various (1) aniline sulfonic acids, (2) naphthylamine-sulfonic acids, (3) diaminonaphthalene sulfonic acids and (4) aminonaphtholsulfonic acids were prepared. With the exception of the salts of NO-diacetyl-aminonaphtholsulfonic acids which had to be analyzed by less direct means, the products were easily analyzed by direct titration with sodium hydroxide and gave results which agreed with one mol of pyridine per mol monosulfonic acid and one mol p-toluidine per mol acetyl naphthylamine—or NN′-diacetyl-diaminonaphthalene-sulfonic acid.

Indanthren Blue

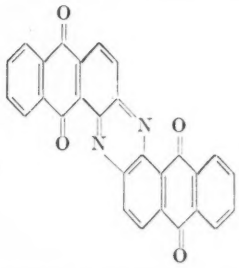
The theory and practice of the reduction and oxidation of indanthrone and its derivatives (Indanthren Blues). H. A. Brassard. *J. Soc. Dyers and Colourists* **59**, 127–29 (June, 1943).

Indianthren Blue RSN (Color Index No. 1106) is widely produced and of considerable technical importance. Although remarkably fast on the fiber, many changes can occur to the leuco-compound of the dye if the dyeing process is not strictly controlled. The possible structural change in the dye molecule when reduction, over-reduction and over-oxidation of the dye takes place and the influence of time and temperature factors is discussed. Since examination, by precise determination of the amount of sodium hydrosulfite required for reduction, shows that two of the keto-groups remain unaltered when indanthrone is converted to its leuco-compound, the probable formula of the latter is



The over-reduction of indanthrone may be caused by caustic soda deficiency, too high a temperature and is accelerated by high concentration of dye, and results finally in the formation of the completely insoluble and non-reoxidisable NN′-dihydro—1:2:1′:2′—dianthroneazine. Under certain conditions less extreme than

required for the formation of the latter compound, the difficult soluble oxanthrone is formed (and the stock-vat is no longer in solution, but in suspension), but this reaction however may be forced to the left by the addition of dioxan. If alkali is not fully removed from the goods before oxidation, greener and duller shades result due to over-oxidation and formation of an appreciable amount of the yellowish azine



Halogenated derivatives of indanthrone (as Indanthren Blue BC and GCD) are more sensitive to dyeing conditions than indanthrone itself but less sensitive to alkaline conditions and to sodium hypochlorite after dyeing.

Acid Dyes on Wool

The influence of acid dyes on the setting properties of wool fibers. G. H. Elliott and J. B. Speakman. *J. Soc. Dyers and Colourists* **59**, 124–26 (June, 1943).

The ability of wool fibers to acquire a permanent set in steam or boiling water is reduced by dyeing with acid dyes. Cardinal Red J. being more effective than Coomassie Navy Blue RNS, Chlorazol Sky Blue FF and Coomassie Milling Scarlet G. In accordance with the chemical mechanism of permanent set, therefore, it must be concluded that some, at least, of the free amino-groups of the wool fiber combine directly with dye-acids. Indeed, the adverse effect of Cardinal Red J on the setting power of wool in steam is so great as to suggest that, in the boiling ammonium chloride dyebath, most of the fiber is freely accessible to the dye.

In their X-ray examination of dyed wool, on the other hand, Astbury and Dawson obtained results which were "incomprehensible if the large dye molecules really had penetrated to, and combined with, every amino-group in the keratin structure." The more organized, crystalline phase responsible for the X-ray photograph appeared to resist penetration even by molecules as small as those of Orange II and Crystal Ponceau. Taken together, the two sets of results suggest that the wool fiber is to be regarded as being composed of accessible and inaccessible phases, which are not rigidly defined, but vary in their proportions according to the molecular size and shape of the reagent and the conditions under which it is applied.

The bearing of this conclusion on the theory and practice of dyeing will be discussed further in later papers.

Fluorescent Chemicals

Some applications of fluorescent chemicals. J. A. Radley. *J. Soc. Dyers and Colourists* **59**, 137–40 (July, 1943).

The uses of fluorescent chemicals in various industries are outlined and discussed briefly. Among the applications related to textiles are: (1) addition of a colorless fluorescent compound to printing pastes enabling faults in printing otherwise not visible until the cloth is finished to be detected at once under ultra-violet light; (2) the use of dyes such as Primuline, Eosine and Benzopurpurine as differential stains to distinguish between various cell structures, in plants and also for fiber identification, under ultra-violet; (3) soluble fluorescent substances as invisible laundry ink; (4) solutions of compounds possessing a strong blue fluorescence

in daylight, as blueing agents. Wool, silk and acetate rayon are best adapted for dyeing to obtain fluorescent effects, but certain direct and vat dyes have a high degree of fluorescence on cotton. The presence of metallic salts invariably causes a reduction in the intensity of fluorescence.

DYEING: BLEACHING: FINISHING

Color

Report of committee on color. I. H. Godlove, Ch. *Am. Dyestuff Reptr.* 32, 340–349 (Aug. 2, 1943).

A newly appointed color committee reports to the American Association of Textile Chemists and Colorists giving tangible evidence of its belief that the scope of its reports and activities should be broadened. In ten sections the report outlines the present status of color science, criteria by which progress should be judged, progress in the last year, and the extent to which progress has actually been applied in the textile industry. The report is an excellent one, packed with information and references on all phases of technical color work of interest to the textile industry. The committee—I. H. Godlove, Ch., Wm. D. Appel, Carl Z. Draves, F. T. Simon, E. I. Stearns, Jr.—has made an outstanding contribution to the industry, one that will be supplemented by publication of a bibliography on color promised for the 1943 Year Book. No textile man with the slightest interest in color should fail to have this report available for reference.

Processing and Dyeing Aralac

The processing of Aralac. Henry E. Millson. *Textile Colorist* 65, 151–59 (April, 1943); 198–203, 206–10 (May, 1943); 245–52, 280–82 (June, 1943); 294–98 (July, 1943).

Aralac, when dry, compares rather favorably with wool in its tensile strength. Its wet strength, like that of rayon, is lower than the dry strength. Aralac may be damaged by alkali, yet it can be boiled in dilute acid for two or three hours without damage. Textile soap may contain sufficient alkali to cause damage at 110° F. or higher. For best results, mild buffered alkalies, such as 3% to 6% disodium phosphate in combination with 3% Deceresol No. 18 or 3% sulfated alcohols at 100°–130° F. for 15–20 minutes, should be used in the scouring bath. If the goods are to be dyed in a neutral bath or dried before dyeing, rinsing must be sufficient to remove the alkali completely. A final acid rinse may be necessary if the material is to be dried. Aralac alone will not full in the same way that wool does. In the presence of wool or fur fibers, it felts very easily and more quickly in the presence of soap than in the presence of acid. Aralac can be carbonized by running 2–5 minutes cold using 2%–3% sulfuric acid, drying slowly and then raising from 190° F. to 240° F. in 11 minutes. Aralac does not bleach readily, peroxide giving the best white and being the safest to use. Overnight bleaching with low concentrations has given the best results because the fibers are not damaged. If Aralac is strongly acid, the fibers have considerable affinity for dyes of all kinds, but the fixation and fastness varies with the class of dye. Generally speaking, all wool dyes are less fast on Aralac than on wool. In contrast to wool colors, many vat dyes applied to Aralac have excellent fastness. All acid and most milling colors dye Aralac satisfactorily and exhaust rapidly and completely except Fast Red BL (Prototype 101). Pre-metalized acid colors work well on pure Aralac and give rich shades when dyed with formic acid. Some chrome colors are unsatisfactory for use on Aralac because they are destroyed by formal-

dehyde which is released by the fiber during boiling and, therefore, give very little color value. If it is imperative to use fast colors to satisfy fastness requirements, then chrome colors should be used since many give rich shades when they are properly selected. The chromate method should be used wherever possible because it is the safest of the three chrome processes. It offers a wide range of chrome dyes and leaves the Aralac with a softer feel and better tensile strength than the top or bottom chrome method. Neutral dyeing colors, such as Calcomines and Calcodur types, have excellent affinity for Aralac as long as the fibers have not been neutralized. After neutralization, many direct dyes have very slight affinity for the protein base fibers. As a rule, the fastness to light of direct dyes on Aralac is equal to the fastness of the same dyes on rayon and cotton. The fastness to washing and fulling is generally inferior on Aralac. The following classes of dyes, diazo, formaldehyde after-treated, basic, acetate, sulfur, vat, and naphthols, also give satisfactory dyeings.

Dyeing Nylon

The dyeing of nylon with dispersed dyes. T. Vickerstaff *J. Soc. Dyers and Colourists* **59**, 92–101, (May, 1943).

Rate of dyeing isotherms at four different temperatures were determined on 22 different dispersed dyes on nylon. By interpolation of this data it was possible to construct graphically a rate-of-dyeing curve in which both time and temperature vary simultaneously and which compared well with observed values. By expressing the rate-of-dyeing isotherm as an hyperbola,

$$K_t = \frac{1}{A - x} - \frac{1}{A}$$

where K is the velocity coefficient, t the time of dyeing in minutes, A the percentage dye on the fiber when t equals ∞, and x the percentage on the fiber at time t, a measure of the dyeing process is obtained which has distinct advantage over the half-dyeing time or the diffusion coefficient. The technical velocity coefficient may be used to show the comparative dyeing rate, select suitable dye mixtures, and provide information on temperature behavior and levelling properties for a given dye. There is apparently no relation between the velocity coefficient and the wash-fastness of the resulting dyeing. The effect of temperature, concentration of dye and effect of the addition of a second dye has been studied. It was shown by a special dyeing method that Hill's equation for diffusion into cylindrical rods was applicable to the dyeing of nylon, and the diffusion coefficients of eleven dyes were determined. The diffusion coefficients in nylon however cannot be related to any property of practical value and therefore lack immediate technical significance.

Dyeing Nylon

The dyeing of nylon with direct cotton, azoic and vat dyes. C. M. Whittaker. *J. Soc. Dyers and Colourists* **59**, 69–73 (April, 1943). Reprinted in *Am. Dye. Rep.* **32**, 335–56 (Aug., 1943).

Direct cotton dyes used for cotton-wool and cotton-silk unions have the most affinity for nylon, and the affinity decreases as the number of sulfonic groups in the dye molecule increases. Success in improving the exhaustion of direct cotton dyes on nylon in an acetic acid dyebath was obtained by four methods: (1) pretreatment with or addition to the dyebath of, beta-naphthol, or a number of other unrelated organic chemicals; (2) pretreatment with water or steam under pressure; (3) pretreatment with or addition to the dyebath

of, certain metallic salts; (4) pretreatment with or addition to the dyebath of, mono-hydroxy alcohols or mono- or di-alkyl esters of dihydroxy alcohols. 100% exhaustion of a 1.5% dyeing of Chlorazol Blue B was obtained with 5% acetic acid and 15% beta-naphthol in the dyebath. With acetic acid alone as an addition to this dyebath, only 26% exhaustion was obtained. With beta-naphthol alone no exhaustion occurred. With suitable direct dyes and proper additions to the bath, the nylon in mixed fabrics may be reserved, dyed at the expense of the cotton or rayon, or the fabric dyed a solid shade. Pretreatment of nylon with water for ten minutes at 150° C. at a pressure of 55 lbs./sq. in. raised the percent exhaustion of a 1.5% Chlorazol Blue B dyebath (from 30% on untreated nylon) to 100%. Pretreatment of nylon with such salts as aluminum sulfate, stannous chloride and chromium acetate gave marked increase in exhaustion of many direct dyes. Pretreatment with dry heat and with certain substances containing sulfonic groups was shown to inhibit the dyeing of nylon with direct cotton dyes. Methods are given for the dyeing of nylon with azoic and vat dyes.

Kier Boiling

Kier boiling cotton piece goods. A. C. Tate. *Textile World,* **93** 91–3 (Aug., 1932).

The more popular method employed for kier boiling today is the one-boil, caustic soda process. The older lime-boil method is still in use although it has been shown that the advantages claimed for the latter method do not hold against a well-executed caustic boil. Among the important factors necessary to successful use of the soda boil are: careful desizing, purity of the caustic, adequate circulation in the kier and proper selection of the kier formula. Methods for operating the kier are described and formulas given. How to eliminate the second boil which has been customary in the case of certain types of heavy goods is outlined.

Mildewproofing

Modern mildewproofing. P. E. N. Cillium. *Textile Colorist* **65**, 359–65, 377 (Aug., 1943).

A review is given of the factors contributing to the degradation of textile materials by enzymes and a survey is made of modern inhibitory treatments with a discussion of some of the advantages in the application of certain methods of proofing. Specific formulas are given.

Fireproofing of Fabrics

Fireproofing cotton and woolen fabrics. Major Robert Van Tuyle. *Am. Dyestuff Reptr.* **32**, 297–301 (July 5, 1943).

A satisfactory method of fireproofing cotton and woolen fabrics has been developed by the Chemical Warfare Service. The treatment consists of impregnating the fabric with a dispersion of antimony oxide (Sb_2O_3) in a methyl ethyl ketone solution of Vinylite VYHH, drying and finishing. When placed directly in a flame, fabric treated in this way will char but will not flame or burn. The fire-resistant properties of the fabric are not affected by washing or dry cleaning. The tensile strength and aging characteristics of the cloth are not materially affected by the treatment.

MISCELLANEOUS

Motor Maintenance

Keep your motors running by preventative maintenance. J. Z. Linsenmeyer and W. W. McCullough. *Textile World* **93**, 65–71 (Aug., 1943).

An adequate maintenance program will do much toward maintaining

peak operation efficiency in textile mills and making existing critical materials last for the duration. This article by engineers of the Westinghouse Electric and Mfg. Co. describes in detail the principal causes of excess wear and of the breakdowns of motors. Proper methods for the care and intelligent maintenance are outlined as well as instructions for necessary adjustments and minor repairs. Maintenance and trouble correction charts are provided.

Cloth Baling System

A streamlined system of bailing cloth. David Clark. *Textile Bulletin* **65**, 12, 31 (Sept. 1, 1943).

A new production-line method for baling cloth developed at the Charlotte (N. C.) Quartermaster Depot is described. The cloth to be baled is stacked upon wooden pallets of special design which are carried by a roller track to the baler. After compressing and fastening the bands the bale is taken by another track for stenciling and sewing. The entire operation takes place without lifting the bales and it is estimated that this system has reduced the labor and expense of baling cloth by fifty percent.

Textile Substitute for Sponge Rubber

Textile inventions solve war problems. Resiltex—an important new textile material. Anon. *Silk J. Ray. World* **20**, 34–7 (July, 1943).

Announcement is made of a new resilient material. Resilitex, it is stated, gives an almost identical performance to that of sponge rubber and has certain specific advantages of its own. Many of its uses are described, among which are pads for seating and other anti-vibration purposes, and for packaging delicate instruments for protection against damage in transit and in use. Compressional characteristics are shown and are compared with other resilient materials. Photographic illustrations of the material are shown but its composition is not disclosed for the reason that Resilitex is on the secret list.

Synthetic Rubbers

A directory of synthetic rubbers. W. C. Holliman. *Chem. Industries* **53**, 63–70 (June, 1943).

Dictionary specifications for each of the synthetic rubbers, now known, and their raw materials, together with a bibliography for each substance covered.

Paper Textiles

Paper enters the textile field with many new products. Anon. *Textile Age*, **7**, 36–42 (July, 1943).

Expansion of uses and development of many new substitutes by the paper industry during the period of war shortages are likely to influence some of the markets enjoyed by the textile industry. For example, by various treatments and plies of various types of paper, shipping bags can be given a high resistance to rain, salt water, gases, sleet and ice. Certain types of paper are being produced with great strength. Strapping is reported to have attained a strength of 125 to 135 pounds. Marked advances have been made in the use of paper yarns in the rug and carpet industry. Woven paper fabric has been developed for floor covering backing and as a substitute for burlap. Paper binder twine is said to have about 50 per cent of the strength of hard fiber twine of equal size. Paper vests for aviators have proved suitable and blankets of paper are being made. Gun covers and equipment protectors are being made of heavy oiled paper. Paper curtains and draperies are coming into use.